## TECHNICAL SESSIONS

### Session 4: Intermodal Freight Network System

### Moderator: Richard Walker, Maritime Administration

Good morning again. Welcome back to the next session which is the Intermodal Freight Network Systems technical panel. I was not sure what is the difference between a panel and a technical session, being that we did not produce any papers, but I will talk to Dr. Parker later to figure that one out.

We will be continuing some of the themes in the previous session – the idea of a balance between security and trade. This panel will take it more from the commercial side, looking at some of the innovative things that are coming down the pike and employing some of the technology that will be explored as well.

Obviously, key to any marine transportation system and actually to the U.S. transportation system is the ports, or the nodes, or the intermodal connections, if you will, within the system. The official flow of cargo as well as the throughput capacity are two of the issues that we are grappling with and how to improve that in light of a decrease in expanding infrastructure. We have to find better ways to move cargo somehow.

At the Department of Transportation, of which I represent in this case, let me back up – I am Richard Walker. I am the Director of Intermodal Development for the Maritime Administration, U.S. Department of Transportation.

One of the slides that you saw earlier this morning talked about the cargo handling cooperative program. That program is within my office. We are looking at a number of technologies and systems that can be tested and put into place. The chair of the CHDP is Gene Pentimonti – I think he is in the audience.

To get back into the theme for this session, we are looking at improvements of intermodal systems and networks that are part of the larger U.S. transportation system. I happen to think there are some interesting things going on here in the United States, as well as abroad. The panel will reflect that.

Recent data that I have seen over the past three to five years as a major pinch-point in the U.S. transportation system has been has been the marine node or the port or terminal area. That is both from the access or egress systems, as well as the terminal operations. What we will do this morning is to examine some of the innovative things that are being thought of. So, the discussion this morning will be taken down just a notch to get some of those ideas in place.

Our panelists today will address a number of innovative ideas that are proposed, are actually underway in some cases in terms of demonstrations, and we have one example where the

technology is actually up and running, and that will be Dr. Franke that we will talk to later about that.

So, what I will do is to introduce the panelists and then I will have them give you a little background of themselves as they come up and speak.

First up, we will have Mr. Blair Garcia who will represent TranSystems Corporation. TranSystems has been working with the Maritime Administration as well as the Center for Commercial Development of Transportation Technologies for the deployment of transportation technologies to look at what we are calling "Efficient Marine-Rail Interface" systems. This is really an off-shoot of their agile port initiative at TRANSCOM.

Next up we will have Mr. Bill Ellis, representing the Port Authority of New York and New Jersey, and he will tell us a little bit about the "Port Intermodal Distribution Network" (PIDN). In my view, this is a specialized example, if you will, of an agile port system or an efficient marine-rail system. But, he is taking it one step further and has introduced the addition of barge operations as well as part of the system. So, that is a unique fixture for the New York piece.

Next up we will have Dr. Peter Franke, representing Noel Crane. They have an excellent example of an inland port concept that is totally automated and I think it is up and running and they are looking at several different locations for that inland terminal concept.

Next we have Mr. Robert Goetz representing CSX. Of course, CSX has been looking at intermodal freight rail systems and networks and he has an excellent example that he will share with us and the technology that has gone into that.

So, with that in mind, as I said earlier, we are continuing the theme of security versus commercial activity. We all know that even in light of security, the show must go on and that is exactly what we intend to do.

## Blair Garcia, TranSystems Corporation

### "Efficient Marine-Rail Interface"

Thank you Richard. As asked by Richard Walker, I will first give you a brief introduction to who I am and what I do. My name is Blair Garcia and I'm with TranSystems Corporation. We are transportation, engineering, planning and design consultants. We have been working for CDOTT, MARAD and the like in developing, analyzing, and assessing agile port technologies and part of what Richard told you about my discussion today is true, but I have added a little bit more information about a recent project that we are completing in the Philadelphia region as well.

So, with that I will begin discussing some technology innovations both on the infrastructure side of the house, but also on the IT integration requirement for some of the technologies being

developed under the Center for Commercial Deployment of Transportation Technologies (CDOTT), the Philadelphia Regional Agile Port System Assessment, the Efficient Marine Terminal Demonstration and a Pacific Northwest Regional APS Assessment, which is similar to the assessment that is being completed in the Philadelphia region.

What is the purpose for developing an agile port system? As CDOTT defines an agile port system, it is a systemic approach to improving marine terminal efficiency and intermodal terminal efficiency, and corridors connecting those facilities. However, the added caveat is the benefit to both a commercial and military dual use, essentially minimizing commercial freight flow disruption during military freight transport deployments.

Some potential benefits of agile port systems and taking a systemic approach to regional freight system and freight infrastructure include the ability to accommodate both commercial and military freight, added flexibility utilizing the variety of terminals, both marine terminals and intermodal terminals, and we will hear from some of the other panelists today about some other intermodal concepts that are being developed throughout the world. Increased marine terminal efficiency and intermodal terminal efficiency and freight transport efficiency essential increases the velocity of cargo through existing and innovative freight transportation infrastructure.

The approach, graphically depicted here, includes a concentration on the three major infrastructure assets and looking at the benefit of connecting these three infrastructure capabilities through an information technology integration. It is very important – without this IT capability and without communicating data across legacy systems, the systemic approach is not possible.

What do agile port systems consist of? Five major components: the first is marine terminals. Those are both conventional marine terminals, agile marine terminals and high-speed sealift terminals and many other terminals. Next we have intermodal facilities and new innovative intermodal terminals such as a terminal that Dr. Franke will review here shortly. Freight corridors, whether they are dedicated freight corridors or existing shared use freight corridors, data and information management is again the heart and soul of this system approach and is the thing that enables a systemic approach to occur. Finally, a system management capability. It is essential that the manager of the data flow within a regional system is a neutral body and a neutral entity to ensure the equal use and equal benefit to all parties involved in sharing that data.

A few of the conceptual marine terminal facilities include a conventional marine terminal (what we call an agile marine terminal – I will show you a few concepts here today), a high-speed sealift or ro/ro facility, concepts such as the fast-ship terminal and what we are calling intermodal interface centers. These are facilities that accommodate intermodal facility operations and potentially, in some cases, marine terminal operations such as storage, sorting and dispatching of cargo.

If we take a DOD perspective, remembering that agile port systems require the benefit of minimizing commercial cargo flow disruption during military deployments, there is a significant benefit to the military. If we take a fort-to-foxhole approach, essentially an end-to-end approach to deploying from CONUS (Continental U.S.), we can consider a hypothetical region and a

variety of marine terminals within that region of potential IIC location. Inland connections – this could be road or rail. Freight corridors – this could be dedicated or shared use between the IIC and the marine terminals. Potential interim marine terminals within the region – their connection inland. Connection between multiple intermodal interface centers, and their connection to the port. Already, we can start seeing the complexities here with the mere transfer of cargo through the system, let alone the data transfer requirements. Finally, sailing on to the destination or the foxhole.

This regional system approach gives the military added flexibility in being able to real-time re-route cargo within the region, for whatever reason – whether a freight corridor is down or if deployment plans change in the middle of the deployment.

Current APS projects that are underway include the efficient marine-rail intermodal interface and I will talk specifically today about the EMT demonstration at the Port of Tacoma, a Pacific-Northwest Regional Assessment, including Port of Tacoma, Port of Seattle and the Port of Portland, and I will give a brief overview of the Philadelphia region agile port system study which has been funded through MARAD and the Delaware River Port Authority to assess the region and its requirements to be implemented as an agile port system.

First, the EMRII system includes the five major components of an agile port system. First, the marine terminal here shown as an EMT or efficient marine terminal. You will see that the loading tracks within the marine terminal are located and aligned perpendicular to the wharf to increase transfer capability between the rail and the vessel. We have a rail storage buffer area for accommodating surges of shuttle trains between the EMT and the inland center or the IIC. We also have a dedicated freight corridor. A conceptual rendering here shows the EMT. This is one concept under a straddle carrier mode, but I will show you other layouts that include RTG and top-pick operations as well. You can see here that we are not changing the type of equipment that is used today. Operations and equipment use is maintained. However, we do find the capability of increasing throughput in this type of marine terminal approximately 100 – 200% of existing facilities. However, to do that, you need an inland center to accommodate the storage, sorting and dispatching of shuttle trains to the efficient marine terminal. You can see this intermodal interface center has a typical truck gate for over-the-road cargo entering and exiting the facility. It also contains a local storage area for collection and distribution of local and regional cargo, and a series of working tracks in the center of the facility for transferring cargo between shuttle trains and trucks and inland mainline rail trains.

In addition, we have an expansion area that can also be used for military staging, rather than staging the military cargo down at the wharf. One benefit of utilizing an IIC facility would be to stage the cargo inland and shuttle the cargo in sequence to be loading onto military vessels.

A dedicated freight corridor connects the two facilities. It needs to be double-stack capable to accommodate the highest level of commercial freight flow requirements. Double-track bypass sidings – we are envisioning high-speed rail and other technologies along such a corridor. Minimal at-grade intersections similar to the Alameda Corridor. Inland terminus close the mainline rail, distribution centers and highway intersections.

The heart and soul of the EMRII system is the data and information management system. Again, this system will do the planning and designation of shuttle train blocks, equipment routing, and planning of operations both in the EMT and the IIC and along the corridor. Finally, the system manager to manage the flow of all cargo throughout this type of dedicated system.

There is interest in agile port systems throughout the country. As I mentioned earlier, the Ports of Seattle, Tacoma and Portland are interested in performing a regional assessment under the Center for Commercial Deployment of Transportation Technologies to review their requirements in implementing such a system. The Port of Oakland is currently looking at ways that they can integrate the Port of Stockton as an inland terminal to minimize truck traffic on local area highways and roads. And, the Delaware River Port Authority also is finalizing their analysis of their regional assessment and we will hear in a few minutes about the Port Authority of New York and New Jersey and their unique approach to implementing a regional system as well.

The Philadelphia Region Agile Port System Study included a lot of participation, both from commercial, military, governmental participants, both looking at high-speed sealift with the fast-ship technology in the area and the Department of Defense participating in developing requirements for military deployments through the Port of Philadelphia.

Some of the task structure – we began by evaluating the system requirements, the infrastructure and other requirements on a regional systemic approach. We then began evaluating the existing and currently planned facilities to determine what improvements may be needed in the future. We performed an analysis of alternative scenarios where we ran a simulations looking at transferring the freight through different facilities and along different corridors. Finally, we developed a capacity gap assessment to determine the improvement needs within the regional infrastructure.

Finally, we identified the next steps which are looking at integrating the intermodal and marine terminals in the region through the new IT system called the Rapid Center. Project participants included the DRPA, who led this effort, railroads, various military personnel, and the Pennsylvania Department of Transportation.

The EMT demonstration is an initiative that was started about six months to one year ago in looking at demonstrating the capabilities of the efficient marine terminal. To date, we have simulated those benefits, but until you actually get out and kick the tires and show that it is a more efficient facility or efficient system, there is still some skepticism in the industry. So, CDOTT has moved forward in starting to develop a demonstration plan which will be completed within the next 3-4 months, at which time we will move forward with a demonstration of this technology.

To understand the EMT better, you must understand its operations. I'll quickly run you through the operations here. Essentially, prior to a vessel arrival, rail shuttle trains arrive into the facility and begin offloading containers into intermodal transfer zones to create empty spaces on the shuttle trains for the initial cargo above the hatch on the vessel upon vessel arrival. The cargo above the hatch begins to be unloaded and loaded directly onto the shuttle trains, while the

shuttle trains are continuing to be unloaded to the ITZ zones. This process continues until all cargo has been stripped above the hatch.

At this time, the cargo above the hatch has been stripped off. The hatches have been removed and we have dug down a distance of one cell so we can begin simultaneous load and discharge. At that point, we take an export container, shown here in blue, load it into that new open cell and take an import container, shown in red, off the vessel and transfer it into the facility. This operation increases efficiencies and increases the throughput of the terminal, maximizing this simultaneous load and discharge is the key element of this facility and this continues until all of the cargo under the hatch has been transferred and the hatch covers have been replaced.

At that time, the remaining cargo that has been staged in the intermodal transfer zones is loaded back onto the top of the hatch and the vessel is finally ready to sail. You notice that the entire facility is empty, ready for the next vessel. The only cargo on the facility is a minimal amount of local storage for local distribution. The rest of the import cargo has left for the IIC to be sorted, stored and transferred.

Physical demonstration requirements in demonstrating an EMT include – we need a vessel first. Washington United Terminals, the home . . . . terminal at the Port of Tacoma, has committed to developing the demonstration plan and upon collaboration with the Port of Tacoma, CCDoTT and agreement on the demonstration plan will move forward with the demonstration.

A terminal location or marine facility to demonstrate this concept is needed. It would be preferable if we could develop a magazine and run a magazine. However, we might have to get a little creative in our endeavors, depending on the availability of space and funding.

Finally, we need rail cars related to vessel size for shuttling the cargo in and out of the marine terminal, one switch-engine, container cranes, yard equipment and the labor to do the work.

A conceptual layout of two magazines and the ITZ locations for a wheeled operation rather than a straddle carrier operation that I showed you, is represented here and was used to develop a layout under a planning system we call the modular grid overlay system. Essentially, we looked at various layouts for the demonstration that include maintaining the basic infrastructure in the facility – the lighting and the rail infrastructure in the same location. However, you have the flexibility of operating under a wheeled condition or a stacked condition with RTGs or even straddle carriers.

Finally, we looked at the infrastructure requirements or the size requirements to develop one magazine. If we go with the reach stacker wheeled mode, we need approximately eight acres. If we go to an RTG-wheeled mode, we have a similar acreage requirement because of that wheeled storage adjacent to the wharf. However, if we go to a straddle carrier grounded mode, we can minimize the acreage needs down to 5.5 acres and the same with a more dense track-side grounded storage and RTG mode as well.

Performance measures are needed. At the end of the day when we finish the demonstration, we need to evaluate the benefit of the system or the concept. We will take measurements,

performance measures of the conventional operations, how the facility operates today, APS operations under the EMT facility operation. Some of the data that will be collected will include vessel operations data, the magazine operation data, cargo transfer and local storage area and gate operations as well, to make a comparison of specific components within a conventional terminal and the EMT, and of course, the demonstration team requires an intense, cooperative approach from the Port Authority, the terminal operators, ocean carrier – which in this case is also the terminal operator, railroad, labor and finally shippers are involved with their data as well.

The EMT demonstration is planned for the Port of Tacoma. However, as I stated earlier, we were also looking at developing a regional agile port system assessment for the Pacific Northwest which is really a bi-state analysis which includes the Port of Seattle, Tacoma and Portland, and will include a simulation of the dedicated freight corridor between marine terminals and the IIC location. Finally, the demonstration of the EMT in coordination with this assessment.

That's all I have for my presentation, thank you.

**Bill Ellis, Port Authority of NY and NJ**

**"Port Intermodal Distribution Network"**

Thanks again Richard and ladies and gentlemen, my name is Bill Ellis and I'm the Program Manager for Port Planning and Development in the Port Authority of New York and New Jersey. In that capacity, I am involved in coordinating the strategic and operational and conceptual planning for physical facilities, technology systems, intermodal systems, mostly focusing on future development of the port to enable it to better serve the region and the country.

In that capacity, I have spent the last three to four years mostly on what would be referred to as port master planning, looking at all the different types of cargoes moving through our port and the capacity of the port and its ability to accommodate those needs in the future. It was in the process of conducting that master plan that we fell upon or conceived of this program which we call the Port Inland Distribution Network, which focuses principally on moving containers through our port and to the region that we serve.

I see a number of familiar faces here in the audience and now that you know a little bit about me, I thought I would just take a second and find out a little bit about you. I suspect that anyone in the audience here will fall into one of three categories with regard got PIDN, and that is – maybe this is the first time you are hearing of it at all; maybe you read about it but have never seen a presentation on it by me or anyone else; and maybe you have seen a presentation on this subject before. So, I would just like to get a quick reading here so I can move through this in a post efficient way to my audience. How many folks are just hearing about PIDN for the first time today? Good number of you. How many may have read about it in the Journal of Commerce or other shipping articles, but not seen presentations? Okay, a few. Okay, folks that have been blessed with some previous presentations that I made? Okay, a smaller group. Okay, those of

you who have seen some of this presentation material before, you will see some new material as well. Those that are seeing it for the first time, I hope it will encourage some thinking and we have a good dialogue about this going in.

I'll also mention that I'm going to be giving a pretty similar presentation tomorrow morning at the panel on Coastwise Shipping. While I will be using essentially the same slides with one or two exceptions, today I am going to try to focus somewhat on a technical technology and implementation issues, and tomorrow I'll try to focus more on strategic and policy issues.

What PIDN is, briefly for those of you who have not seen it – this is the principal market area that the Port of New York and New Jersey serves. We actually move containers from all parts of the world to the entire United States. But, most of our containers go to this area. What we are talking about is an area that is principally served in terms of inland distribution today by truck, with the exception of major railroads like NS and CSX and Bill Goetz' CSX group moves quite a number of those container groups inland. What we are trying to do is develop an alternate system for moving containers inland. You see here a barge route, hub feeder system of potential feeder port locations up and down the coast, and up the Hudson River to places like Albany, Bridgeport, Davis. . Rhode Island, Wilmington, Delaware, and the rail inland port network that reaches other areas further into the country and Pittsburgh and Buffalo and other places in upstate New York.

Currently, again, most of these locations are served principally by truck. This is the concept of it. What I would like to do is lead you through how we came up with it – why it is important and some of the implementation issues and new technologies that we're applying to make it work.

I mentioned before the background for this was our master plan. This is a forecast for containers that potentially could move through the Port of New York and New Jersey over the next 40 years. We currently handle about three million TEUs – that is 20-foot equivalent units through the port. That represents about a 4.2% compound annual growth rate. That is fairly typical for an expected growth rate in ports in the United States. The implications for this kind of growth rate are many. We simply don't have the terminal space in the metropolitan New York/New Jersey area. We would perhaps have to create new terminals. We have this tremendous modal split for that region that we serve right now – about 86% by truck. The environmental impacts of that are really dramatic if you think about going from three million to 16 million TEUs and moving that over our roadways. You see the chart of return on investment. Developing new terminals, whether we acquire them and modernize them, or had to develop new ones from creating land which is an environmentally time-consuming process and a very expensive process, we believe would seriously affect our ability to function financially.

We end up with this pie chart that is says damned if you do; damned if you don't. If you do go ahead and provide this capacity, and handle all that cargo that really does want to go through your port, you are probably going to go broke. And, if you don't do it, the cargo will go elsewhere. So, that led us to a mode of thinking that said – we've got to approach these problems differently. We tried to step out of our traditional landlord port-development mindset into – well, how would we approach this problem if we were a total systems logistics provider.

We have to understand all aspects of the flows, origins and destinations of containers, and associated handling issues in order to figure out what our appropriate role is in the future.

We hypothesized that if, in fact, that vision that I showed you earlier of moving substantial numbers of containers inland by rail and barge, rather than by truck, could be accomplished, that we would achieve a variety of goals, reducing inland transportation systems, at least theoretically because of economies of scale from the . . . freight movement system versus a single truck, reduce truck trips on the roads, which has a variety of benefits of air quality, congestion mitigation, etc. Also, the benefit through using greater rail and barge inland transportation agile port concepts, as Richard mentioned, that we could improve the throughput capacity at existing terminals. We can perhaps even grab some additional market share. All these goals, of course, were yet to be achieved and are certainly enough incentive for us to go ahead with this.

As we get into the program, we realized many other benefits that could accrue, not just to the metropolitan area that we serve principally, but the entire larger northeast regional area. The decentralization of economic development by creation of activity at inland feeder ports where presently ports and other inland locations have been de-industrialized from their past infrastructure in a large way by containerization, the changing nature of ports over history. Also, the ability to, at feeder port locations, construct warehouses that would, in effect, be on the port. In the hub port, we are basically demolishing warehouses to make room for container terminal capacity, yet at feeder ports, they have an opportunity to meet industry needs for warehousing on dock, and that is a significant benefit as well. And, lastly, energy conservation and fuel efficiency of rail and barge movement versus the truck.

So, looking at the first step in this total logistics provider analysis was to look at the market and this is a graphic representation, and my thanks to Moffit & Nichols Engineers and John Recklus and Lloyd Thompson who were in the office here helped me greatly with the graphics and the analysis of this data. You see represented a GIS database of every container for a one-year period that moved in or out of these 17 states. We have it through our port and other ports. We have it down to the zip-code level. We needed to know that to understand what the opportunities might be for mass freight movement, versus the individual truck. This graph shows a histogram of the distances from the port, how many of those containers are currently moving in terms of miles from the port. You see that about 40% of the containers are within 75 miles of the port, and then it drifts off in the suburban areas surrounding the port. Then you have these bigger humps – 200-300 miles from the port. Again, we posited that these would be the greatest opportunities for setting up mass freight systems.

Here is some structural discussion and we will get into how we think we can make this work. What I have tried to do is identify here in general terms success strategies. These could be implementation issues that are necessary in order to create something that hasn't happened naturally by the private sector. You will see we are talking about developing new structural relationships that haven't existed in the past and principally that will be this partnership idea between public and private to create something that cannot be otherwise created by either one individually; utilizing new technology and I'll have some examples of that; making sure that fundamentally it works financially achieving economies. That is something that takes a while. That is something that doesn't happen overnight. Providing customer value beyond the simple

service that we're providing the movement of containers. There are many, many other elements of this program that are of value to carriers and shippers and we will touch on some of those and at other presentations tomorrow, John is going to touch on those in greater depth. So, please if you are interested in that aspect, stay tuned to that presentation. And significantly, the public benefits that can accrue from such a system.

This is a busy slide that represents the mainline flow of the containers right through the middle there from foreign ports into a hub port, relayed by barge or by rail to a feeder port, and ultimately most containers are delivered by truck to the customer. You see two different arrows between the feeder port and the customer, recognizing that to the extent that customers can and want to locate on the feeder port, they can eliminate a local truck dray and go perhaps right from the barge or the rail system, right to their warehouse and do their distribution and other activities from that location.

Up at the top you see this PIDN coalition. It is a concept that we recognize that a system like this requires partnerships between two ports at either end of the system to try and draw upon resources that they can bring to bear, whether they are federal, state, or local. There is some financial public assistance that is needed to pretty much jump start or initiate these systems. Again, you will see the argument that there is tremendous public benefits that can accrue from this that would justify that public assistance.

Complexity of port inland distribution network functional relationships – here this really busy slide involves the many different players, terminal operators, truckers, carriers, technology providers, federal agencies, the regional and hub port authorities. There is just so many different connected activities, relationships. Some are contractual other services that really need to be nailed down and specified amongst all these parties in order to do something that, to a large degree, is not happening today. This is one of the challenges of understanding all of the roles of these different parties and finding the win/win solutions that interest them all.

In terms of technology, one of our key platforms for technology in the Port of New York and New Jersey in the future is the first system that is freight information real-time system for transport. Karen Toby in the audience here is a manager for that program and this slide indicates quite a number of the many different maritime-related systems that are linked together through the first portal. You will see that we anticipate meeting the needs of the port inland distribution network from a technology standpoint through this portal as well.

Another aspect of the technology is the handling of containers themselves and this is an excellent slide and hopefully will be parallel to some other slides, since we have our friends from Europe here presenting. This, in fact, is the European model of the inland barge port that shows on this schematic diagram across the bottom. There is tremendous opportunity to load containers directly from barges by a single piece of equipment into a yard or directly to a warehouse – a tremendous amount of efficiency opportunity there in that technology. We don't have such a system deployed in the United States yet, to my knowledge.

The economics of these routes – each individual route has a unique set of economics and they have to do with a variety of factors of infrastructure that is already in place – labor agreements

that are in place, and the origins and destinations of cargo and the imbalance of that that changes the nature of the economics of the logistics system. What we do for each one of those locations or routes is we look at all of the cost elements for a truck delivery system versus the proposed barge delivery system or rail deliver system – whichever it is for that location – and look to determine what the relationships have to be, what cost elements need to be challenged down in order to come up with a favorable cost structure that will entice the shippers or the carriers to want to use this system. Fundamentally, they do want to save money. They are not doing this to take trucks off the road.

This slide illustrates a concept that I mentioned before that shows that the barge economics over time, and fundamentally what it comes down to is that in order for a barge and rail system to effectively compete with the truck from a financial standpoint, the barge or the rail system has to be fairly fully utilized – 80% or 70% of the capacity that is provided for those unit economics to compare favorably to the unit economics of a truck. You don't instantly go from start-up service to a full barge load to any one of these routes. It takes some time to get people to change their behaviors to prove that the reliability and service, and that the system is real. And, a truck only needs a load of one to be efficient. A barge, as I said, and there are different sizes of barges, and rail systems compete on the same basis.

So, over time we are projecting that many of these routes will become financially self-sustaining and will not require public assistance. This demonstrates that support is only needed in the start-up in order to get these things going. You see at the bottom the modal split that is anticipated from the current to what we feel is a reasonable opportunity based on those, again, distance dynamics and positions of containers that are currently moving through the port.

Additional customer values, beyond those economic, the all-water service is a tremendous value; overweight containers can hold 30 tons of cargo, but they can only move over the road with 20 tons of cargo. 30 tons of cargo moving over a ship overseas from a barge into a feeder port can eliminate a truck and one-half trip, for example, with one container rather than two over the road. Similarly, that warehouse relationship, whether it is to overweight or value added, is another value added. Service reliability and redundancy – what we are talking about is the redundancy of the transportation system for the nation. We are so reliant on the highways that we don't have the ability to increase drastically to accommodate a five-fold level of increase in trade on our highway system. But, more important, I think events over the last couple of months have indicated to us the importance of redundancy in our transportation systems. There, I think the marine transportation system has a tremendous potential to aid the economy of the nation and reliability of flow of its goods and services.

Similarly, responsive, flexible delivery options are being programmed into the service. We do not want to envision PIDN as a commodity, but as a designated specialized service tailored to the needs of the customers.

Lastly, an important issue that can be facilitated by barge and rail system is improved asset management for carriers in terms of chassis and empty container utilization. Again, I'm not going to dwell much on those topics because John Recklus will speak about them at the next panel.

I would like to move on and close with a brief discussion with the public benefits identified. The first and most obvious is that by putting in a freight movement system that is water-based, the water is already there, so significant infrastructure . . . . . of freight movement corridor of that size, traditional highway means. Freight transportation cost savings are another benefit and this, again, is something that does not accrue necessarily in the early years when there is a need for a subsidy, but long-term. The mass freight economics does drive in when you have these barges 80% utilized and rail systems matched to the market with balanced loads, which means substantial freight transportation cost savings to users. That is fundamentally why we are doing this as well.

The jobs, the sales, the taxes – this represents the economic development benefits that are mostly derived through the feeder port locations, and the warehousing and handling of cargo at the new feeder port locations.

The other benefit that is significant in terms of being able to quantify readily is the reduction of vehicle miles traveled on our roadways. These can translate into, as I say, congestion and air quality benefits. We made an attempt here to try to illustrate on two different sets of roadway systems those within a 75-mile radius of the port, and those beyond the 75-mile radius of the port. Computing for every one of those containers you saw, the equivalent vehicle miles traveled by trucks and if we were able to capture, for example, 80% of those that were traveling beyond 75 miles and put them on barge or rail systems, what the reduction would be in terms of EMTs. You see from these tables, quite dramatic reductions were we able to do this immediately, or, looking ahead in 2020, what type of savings that could mean to the country and the metropolitan area as a whole.

If I could draw your attention to the two forecasts for the 75-mile radius roadway systems without PIDN in 1999 and with PIDN in 2020, you see 112 million EMTs in 1999 and about 116 million in 2020 on metropolitan roads within a 75-mile radius of the port. In essence, it means for those roadway systems we could absorb almost 20 years of growth with little or no impact coming from port-generated traffic. That is a huge selling point for us.

Additionally, you see tremendous savings regionally for the zone 75-400, both immediately and long-term – substantial reductions there.

The environmental benefits – this is just to say we are in the process of quantifying the emissions value of barge rail movement of containers versus truck for those inland opportunities that we have identified.

This closing slide illustrates a projection on our part that if we were able to put the system in, if the system becomes utilized to that level of 80% or so, what we believe the concomitant benefit might be directly to the hub port in terms of acceleration or velocity of the movement of containers through our port. You see at the bottom our productivity projection of about 3,500 lifts per acre without PIDN. That is not what the Port of New York and New Jersey is doing today. That is our stretch goal for doing that with pretty much existing technology and expected improvements without PIDN. This next computation is of about a 20% throughput

improvement. Again, to some degree, these estimates are theoretical and can be computed based on different assumptions – the types of equipment, the density storage, etc. But, it does drive home the point that there are a variety of public benefits, hub ports, feeder ports, nation, consumers, and real economic benefits as well.

That is the essence of the program. I look forward to discussing it with you. Thank you.

**Peter Franke, Noell Crane Systems**

**"Inland Agile Port"**

Ladies and gentlemen, it is with great pleasure that I accepted the invitation to come here to America to this conference and I'm proud to give my presentation under this famous roof of your national academies. I'm here representing Noel Crane Systems which is a German company and which is part of the Fantuzzi Reggiane Group, the biggest supplier of crane-handling equipment worldwide.

The subject of my presentation is two-fold: first, to reassure academia that promising concepts like the Agile Port System, are technologically feasible; and second, to report in more detail about the inland agile port which is an issue in Germany for years already.

On the major containerized trade routes, container shipping is growing by 6-8% per year <Fig. 2>. What does it mean for the container ports? Here you a see a diagram showing key figures of European container ports in the Northwest range which means Belgium, Netherlands, and Germany <Fig. 3>. The upper part of the table shows existing terminals. Now, we see that the Delta Terminal of Rotterdam is in terms of throughput per meter quay, the most advanced. They have about 800 TEU per year and meter quay. If you look at the throughput per crane, that is about 155,000 TEU per year and crane. That is in the Port of Antwerp. But, now it is interesting to see that in Europe, two new modern container terminals are under construction – one is in Hamburg, the Altenwerder Terminal, and one is in Antwerp, the Left Bank Terminal. The outcome is that they plan to double throughput per meter quay, which means they are trying to achieve 1,400 TEU per year and meter quay. Then we see on the other hand, the throughput per crane in TEU per year remains about the same. This shows that not the crane is the bottleneck today, but that they want to optimize their yard operations. Thus need number one in marine terminals, is rising yard productivity by keeping quay crane productivity.

How do they do that? Here we have the type of quay cranes which will be installed in the Port of Antwerp at the left and in Hamburg on the right side <Fig. 4>. On the left-hand side, this is a picture of the biggest cranes in the world, an average outreach of 66 meters. On the right-hand side, we have a two-trolley quay crane.

What is the technology for the horizontal transport? The automatic vehicle on the right-hand side is an AGV system which has to be loaded by the crane and on the left-hand side, this kind of

equipment will be installed in Antwerp – a straddle carrier type of vehicle to travel between the quay cranes and the stacking cranes <Fig. 5>.

Then we have the automatic stacking technology. In Hamburg they will have a gantry crane system, and on the right-hand side this shows the type of crane they are going to install in Antwerp, an overhead crane type stacking crane <Fig. 6>. These components of the container terminal are the basis for an agile container handling system.

Need number two: Major container ports will have to reduce dwell times of ultra-large container vessels <Fig. 7>. Just imagine, you cannot put more than 6-7 ship-to-shore cranes at the side of such a big ship. On average, such a container crane is able to do 35 moves per hour. So, if you have seven of these cranes, you make 245 moves per hour and ship. If you want to maximize this, you have to have another type of crane. This kind of crane will have several trolleys in order to make parallel actions. We have investigated three different types of multi-trolley cranes and compared them to a conventional crane and you can see a two-trolley type like it is installed in Hamburg already – has a 1/3 better performance. If you have two trolleys which are penetrating each other-one may go through the other-then you have about a 2/3 better performance to expect. Then at the far right, this is a three trolley crane where you have two trolleys for the lifting and one horizontal transport trolley. This is the answer to need number two – reducing dwell times of ultra large vessels <Fig. 8>.

Need number three is reducing highway congestion <Fig. 9>. And need number four is shifting container storage capacity inland <Fig. 10>. The storage capacities required ashore are exploding. The answer to both is the Agile Port System which was presented two speakers before: Splitting the marine terminal into two parts in an Efficient Marine Terminal ashore and an Intermodal Interface Center inland, both connected by a dedicated freight corridor <Fig. 11>.

You've seen ideas before how such an Efficient Marine Terminal may look like. This is a competing idea <Fig. 12>. It is the first time that you are able technologically to load and unload rail cars directly at the quay. The reason why it is possible is that you do not have to move the quay crane in parallel to the ship because then you have lost. What is absolutely necessary is that the quay crane concentrates on the bay which it is digging in. So, as soon as it is leaving it, the performance will drop down. So, what is done here – we separate the loading process between vessels and container train. So, this big gantry crane looks almost like the one installed in Hamburg having got an intermediate platform. The container unloaded from the ship is just put on the platform and then again the seaside trolley on the quay crane will concentrate on the next container. Meanwhile, the container put on the platform will be conveyed a step sideward. Here, a rail-mounted gantry which is traveling between the legs of the ship-to-shore crane will serve this platform and put the container directly on the train, or if there is no slot, will put it on the sorting facility. So, if there is no slot, it puts it on the sorting facility with a number of independent shuttle cars. These are able to go to the right and left side and go forward and backward by just turning the wheels by 90 degrees. I hope I have a chance to show you a film where you will see that.

This picture shows the sorting facility which you absolutely need because of the synchronization between the loading process on the train and on the vessel.

The Inland Interface Center is a subject we are dealing with for years already in Germany <Fig. 13>. There was a competition about five years ago among the leading industries and the German Railways wanted to have a system which replaces a shunting yard. A shunting yard is a very time-consuming facility and the idea is that the containers will be transshipped between trains instead. Trains are coming from source terminals somewhere. These may be also marine terminals and as soon as the containers will be landed, they will be loaded on trains no matter which destination they are bound for. Then they go to a central knot, the Intermodal Interface Center, and there the load will be consolidated between the trains so that trains with loads for only one unique destination or relation will leave the hub.

How does it look like? We have an area of only about 80 meters times 700 meters. 700 meters is the maximum length of the trains in Europe. You can enter with up to six trains in here. They will come in a time distance of eight minutes. So, at time zero the first train comes in, after eight minutes the second, after sixteen minutes the third, and so on. So, after 40 minutes, all 6 trains are in and they are all together in about 20 minutes, and then leave every eight minutes. So, within 100 minutes, you can interchange the loads of all 6 trains which are about 360 containers to be moved between the trains within 100 minutes.

This is another view <Fig. 14>. Here you see the rails for the freight trains. Again, here you see the sorting facility. Of course the gantry crane tries first to transship directly between trains. But, if the free place is not within its reach, it puts the box on the sorting facility, the box being transported in parallel to the trains, to another gantry crane, and then will be loaded on the target destination on the outgoing train.

This is such a wagon photographed on our demonstration plant in Würzburg. You can see this is just a frame of steel on wheels. Quite stupid, which is very necessary with respect to maintenance. It cannot be stupid enough. Then, how is it propelled? You have magnetic strips under the rail carriage and in the runway linear motors. They contain wires and you put an electrical circuit to it and there will be produced an electromagnetic force and it just propels the wagon forward, backward, left or right. What you can do is position this wagon up to three millimeters exact. This is ideal for all automatic functions between cranes and for horizontal transport vehicles <Fig. 15>.

This is the outcome of the simulation: The worst case is that you have these 360 load units to be transshipped between trains within 100 minutes. Therefore we need 10 cranes and 40 linear motor-driven wagons. But, if you only have 320 load units, how many cranes do you need then? That is eight and you need 32 of these linear motor-driven wagons. So, you have a relation of four wagons to one crane <Fig. 16>.

The maximum performance of the sorting facility was verified by a detailed simulation. There was a PhD thesis from the University of Hanover and it took the gentleman about 2.5 years just to model it in detail. There are certain layers of modeling and the outcome was that it is possible to sort 360 containers in 100 minutes.

This is the main advantage of this mega-hub in comparison with the shunting yard. This is the time spent in the shunting yard in order to service six trains with 40 wagons and each having 60

containers on top. You are interested in when will the first train leave again the shunting yard? It takes at least five hours and twenty minutes. If you go into such a mega-hub where you transship which is a parallel process, up to 10 cranes can transship in parallel from one train to the other instead of shunting wagons one after the other. So, there is only one hour and ten minutes which is very necessary for us in Europe because that means that we gain three hours from trucks <Fig. 17>.

Then here – the space requirement. Because a shunting yard is a thing which is very long, you have to get the trains in, you have to push them across the hill, and you have to sort them in another portion behind and at the end you have to put all the trains together again. It is about 5-7 kilometers long. So, we would not be able to find places anymore in Germany to install a shunting yard in order to form a hub and spoke system <Fig. 18>.

The first Intermodal Interface Center should have been built already. The discussions have been going on for more than five years already. It was already on the list for the world exhibition Expo 2002 in Hanover. Then the German Railways were privatized and nobody felt any more responsible for innovations. But, we are quite sure that in the next year, a step forward will be made in order to install this in Germany. All parties agree being involved in the private operation <Fig. 19>.

So, just to summarize the advantages of the Agile Port System. By implementing the Agile Port System, land shortage ashore as well as road congestion belong to the past. All parts of the split marine terminal are each highly space economic, and are connected by a dedicated railway line. Each part of the EMT and IIC combines gantry cranes with the highly efficient box mover. The efficient marine terminal allows for the loading and unloading of trains next to the quay cranes, and sorting of containers in the Intermodal Interface Center is four times faster than in shunting yards <Fig. 20>.

Now, I'm going to show you a movie how that works in the IIC (MegaHub). (VIDEO)

That brought me to the end of my presentation. I thank you very much and I just want to let you know that we are a German company and that we have an U.S. American subsidiary. Due to the incidents of the 11 th of September the chair was kind enough to give Noell the opportunity for another short presentation dealing with a straddle-carrier based x-ray system. I give the podium to Michael B. Krupp, a colleague of mine. Thank you very much for your attention.

**Mike Crock**

Thank you, Dr. Franke. As you mentioned, I'm here from Noell Crane & Service. We are based out of Chantilly, Virginia and we are the North American sales representatives for Noell Crane Systems based out of Germany. We sell the ship-to-shore cranes, rubber tire gantry cranes, rail-mounted gantry cranes, and straddle carriers. This led us a few years ago to develop an x-ray inspection system which is basically a hybrid of a straddle carrier. We developed this system with an x-ray company called ARACOR based in Sunnyvale, California.

We first developed the x-ray system about three years ago. We developed the first prototype that has been, for the past year, in use at the Port of Miami by the U.S. Customs Agency. They have been very successful with it. What the Eagle does is it passes over the containers, one high or two high, and produces an image of what is inside them, be it drugs, contraband, explosives, weapons and also we have a patent to detect nuclear material. So, in these times, we decided it was good time to come forward and push the Eagle.

So, I will play a video for you which shows the Eagle in action.

(VIDEO)

**William Goetz, CSX Lines**

**"Intermodal Freight Rail"**

I am very honored to be here. You have heard from a very distinguished panel. If you look to your left and right you can reach out and touch yet another industry expert. So, I'm very pleased to be here.

What I would like to talk to you about this afternoon, you've heard from distinguished experts and you've learned about some leading technologies. The question that must be going through your mind is when are we going to see some of these things in action. What are the barriers between seeing things in movie clips and presentations here in the nation's capital and seeing something out in the ground in the gritty suburbs of New Jersey or upstate New York or Chicago, Illinois. That is where the true test comes.

Before we begin, I should be very careful in my use of terms here. Intermodal means a lot of things to a lot of different people. But, I'm a career railroader and intermodal has a very distinct meaning to me. Intermodal means the movement of trailers and containers on railroad trains. Just like you see here in this picture. My use of intermodal, that is the concept that I'm going to speak to you about this afternoon.

You need to know that the North American intermodal industry is a private sector business. It is primarily the province of six large Class I railroads. I work for one of them and I can tell you definitely that my employer is a for-profit enterprise. Amtrak is also involved in this. Even though they are a ward of the government, they operate their business with private sector economics.

So, the question is – how will private sector economics receive and treat some of these new technologies? Without a favorable response, they cannot go forward here in North America. Now, probably some of you are saying, oh my gosh, here comes some Wall Street myopic guy who is only concerned about the next quarter earnings. He is going to throw cold water over this entire presentation. I assure you, stay tuned – that is not my objective. My presentation is actually quite bullish.

So, to begin, let's jump off and this slide is actually probably incorrect given the character of the audience. It should really read – four things you need to know about intermodal, some of which you probably already know. So, we can move through these pretty quickly.

First of all, you need to know that this is a viciously competitive business because it has no pre-ordained franchise. It has no exclusive franchise. Just about everything we move on our intermodal trains begins its shipment on rubber tires and ends its shipment on rubber tires. Truckers go everywhere and everything could move on trucks if we are not competitive. So, our competitive advantage has to be earned shipment-by-shipment. There is always somebody ready to take our business away from us.

The second thing is that it is a very service-oriented business. People ask me, what are in all those containers that you move. The question is that it is typically the stuff you buy in consumer stores. It can be everything from a box of Tide to a PC to an oily greasy part that somebody is going to bolt inside a Ford Escort. But, regardless, there is one thing I can tell you for sure – whoever owns it is very anxious to convert that thing into cash. They want to know where it is. They want it to get to its destination and they don't want a lot of guessing and problems enroute. They want that thing where it is going so they can sell it and convert it into cash.

The third thing is that the intermodal network today is basically something that has been in creation for 50 years. It has been evolving and its evolution is interesting because it has gotten smaller. The network has gotten smaller as time has gone by. It has condensed down into a very, very select network of high density, high efficiency points.

Finally, you need to know this is a growth business. This shows our recent activity in the United States throughout the 1990s and I think for 2001 it will probably be the first year that we show a little bit of a dip. As you can see, we got through the 1990-1991 recession by plateauing off, but this recession has been pretty nasty and so we will probably for the first time in quite a while, we will see a dip this year.

You need to know a little bit about CSX. Besides signing my paycheck every month, CSX Intermodal is a billion dollar company and it is a fully-integrated transportation company, operating a nationwide network of 48 terminals. It also has a large trucking operation and offers fully-integrated transportation products. We operate 300 dedicated intermodal trains every week, and we move about two million containers a year. So, we are big player in this. It is a very good organization to be associated with.

So, now that you have the background and you've heard the commercial, I think we need to delve into this economic subject and you can understand this in three small pieces.

First of all, let's talk about how intermodal's competitive advantage is created. I've told you this is a hyper-competitive business. So, let's talk about how we maintain that competitive advantage. First of all, our competitive advantage improves with longer distance. So, that train you see up there, the longer it is going, the more competitive it is going to be, and the more chances that train will operate tomorrow, next week and next year. The reason for that is that any – this is a general concept of intermodalism – any intermodal mode changes requires time

and costs money. So, the longer distance you can put between that, you can spread that cost over a larger mileage and move down your per-unit costs.

The second concept – large train-load volume. The largest component of cost is the engineer and the conductor that is sitting in the locomotive of that train. The more containers you can put behind these men and women in that locomotive cab, the lower you can move those unit costs. So, the big train is more economical than a small one.

Finally, a concentrated geographic distribution – the final dray movement, the truck movement, is expensive. It is time consuming. So, the more concentrated the traffic distribution pattern is, the more economical and the more competitive that intermodal move will be. Now, traffic coming off ports already has one point of concentration because the vessel does that for you. So, traffic coming out of a port is concentrated by definition. You've heard some of our earlier speakers talk about traffic that is already moving via rail, traffic coming to the East Coast from the Port of Los Angeles, or traffic going through the Port of New York and going to Chicago. It fits all those characteristics. Those are big ports. They big large concentrations of business. They are going to big cities where there are a lot of consumers. They move in long trains and intermodal is very competitive over those longer distances.

Now, don't just take my word for this. This shows some recent information on intermodal market share. The top graph in yellow show that the intermodal market share against all modes improves with the length of haul, and really improves when you get out into the longer haul movements, over 1,500 miles. As you can see in the very shorthaul moves, there is very little intermodal penetration. You might say, that doesn't sound so good because we are talking about shuttle moves and inland port networks and the rail guy stands up and says that he practically has no penetration in those segments at all. I'm here to tell you there is a way around that. The answer is somewhere in this matrix.

What you see here is a little primer on intermodal economics broken into those three categories.
. . . . . .

. . . . . we actually have a live example that I'm going to close with. What you want to do is try facilities that are already there. You want to use trains that are already running, that are already economically sustained by something else. Use those and integrate those into an inland port distribution network. This is precisely what we are doing at CSX.

So, to sum up on economics, here is the answer. Inland port services, even very short shuttle services, can thrive under the right conditions. What are those conditions? The capital facilities need to be already built and they have to have capacity in place. Secondarily, either the inland port business has to have grown to a very high concentrated volume level – in other words, it has to be a success or has to have been a success, or you've got to use train operations and facilities that are sustained by some other business portfolio and that have capacity to offer to that inland port network.

Let me close with an example. Here we are at New York and New England. If you drive from New York to New England, it is 191 miles. That is a pretty short haul. Unfortunately, you have

New York as about 10-20 of those miles, so there is somewhat of a rail advantage built in with that. But, we at CSX today offer a rail service between the Port of New York and Worchester, Massachusetts and it is a successful service. It has been in operation for a number of years. What makes it a success is that all the trains that this service utilizes are justified by something else. A container headed to Worchester from New York climbs aboard a train that actually began in Jacksonville, Florida and is completing its last leg from the southeastern part of the United States up into New England. It goes up to Sulkirk, New York which is that intersection you see and then turns right and it moves into Worchester, MA. Going backwards, we ride trains that are heading west out of Worchester and then trains that are heading south. Every single train that this service uses is really justified by some other type of service. But, by doing that we are able to offer a cost competitive service that wouldn't exist otherwise.

These are the concepts that we're using at CSX to embrace some of the new concepts that are coming at us particularly from the Port of New York and other ports along the Atlantic seaboard. This is something you definitely need to be cognizant of. It is a concept that is coming. You heard from experts today and I'll be very happy to answer any questions as we close.

Thank you.

Walker – We do have a few minutes left. We will now entertain questions. Please speak into the mike.

Question – I have two questions. One is where does the Customs personnel work in the port inland network, and the other is, can anyone discuss and compare a port inland distribution center versus a global freight village. There are about 40 of them in Europe. They are right near the port, airport/seaport combo within a 10-mile radius and they do intermodal distribution marshalling much closer to the port. So, first is where is the Customs? Secondly, global freight villages?

Answer – Customs has a couple options. They can pre-clear cargo at the hub port and release it for distribution through an inland destination, or they can choose to do the clearance of the cargo at the feeder ports. It really will be entirely up to them. They do have, at some of the feeder ports that we've been talking about, Customs staffing and operations are ready at some of the inland ports. That level of determination has not yet been made by Customs. They are somewhat under difficulties now certainly with security and other aspects of the handling, and also need to coordinate the planning and implementation of this within their own budget constraints and therefore the utilization. So, my guess is they will make their decisions based on their view of the best utilization of the resources that they have and it may vary from location to location.

In terms of the global village concept which I am taking from your definition of it there and having seen first-hand some of the operations in Europe, I don't think there is really any difference in terms of the opportunity that could be developed at an inland feeder port as we have discussed here. It would be, in essence, the integration of the transportation network and the distribution facilities emanating from that and the associated jobs. The difference you do see in Europe gets back to the exactly the points that Bill just paid – distance, the further the distance,

the greater the economics. In Europe, they have a different cost structure for some of the transportation systems and they also have a different penalty for the truck which they can feed it against in terms of fuel and congestion on the roads, which tends to drive those global villages to be closer to the port. So, in effect, the European ports and inland ports are 20 years ahead of where we are relative to volume and relationship to the capacity of roadway system and certainly if you look at fuel costs, etc., there are a lot of different factors so you can't just compare it on a geographical base. That is my view and maybe some of the panel . . . . . have some thoughts on that.

Comment – I would like to add a comment to your Customs question. Today we move a tremendous amount of intermodal cargo that comes through both west coast and east coast ports that has not yet cleared Customs. It moves on the railroad's bond and that freight will clear Customs at the inland point. So, coming in through the Port of New York and clear Customs in Chicago. Typically, the dwell on an international container inland could be 5-7 days, not only waiting to clear Customs, but that box will go nowhere until the steamship line is assured they are going to be paid for it. So, unfortunately, the money does not move as fast as the container sometimes. So, Customs and money have to catch up to the container flow.

Walker – I would like to personally thank the panelists. I think the presentations were excellent. I think I am totally enlightened with some of the comments that were made. I would like the audience to please join me in thanking the panelists. That ends our presentation. Thank you.

## TECHNICAL SESSION 7: ITS TECHNOLOGY AND INFORMATION

### Moderator: Richard Walker

I'm glad to be part of this. This is again something I am working on in conjunction with the intermodal network systems that we talked about this morning. I think it is important and I had no idea what Bruce had in mind when he put the conference together, but it seems to be a logical progression down to this particular panel.

Here again, there are no papers involved. We are talking ideas and concepts that were actually in the works in terms of demonstrations or actual application in the field. Obviously, they have a number of security elements to them and I understand something just developed recently that SAIC will probably tell us about – one of their projects that they are being engaged to do as well.

What we are seeing and what we saw this morning, as well as this afternoon, is that information is key to what we need to know. Obviously in terms of the transfer of information as well as processing that information, it seems that ITS technology the mode by which we can expedite that process faster. So, it is obviously an important piece of what we're doing here.

The panel will address technology pre-09/11, but they are being looked at seriously now in terms of security. Some of the things are already in place – like the optical character recognition technology. We mentioned Mar Terminal which has the system up and running which is quite efficient. It has been tested around the country. It has been tested by Crowley Maritime in Jacksonville – I do believe. By the way, that technology was explored almost 7-10 years ago through the cargo handling cooperative program and we didn't pick it up until Mar Terminals decided to look at it very seriously. Here again, the economics part of this was an issue.

In talking about the technology, the most important thing here is how the technology is allowing information sharing among partners that are normally not used to sharing or cooperating. That includes most of the intermodal entities that are normally very, very competitive. But, they understand the importance of sharing certain elements or certain pieces of information. What you are going to hear is that we have begun to do that in earnest.

We have four speakers with us today. I'm going to use the same technique that I used this morning. I will introduce them in terms of their organization and topic. I will have them to further introduce themselves in terms of their background. We will hold questions until the end. Hopefully, our coordinator will not let me run over as I did this morning. I told him to get out the whip so we can stay on target here.

First up, we will have Mr. John Lutz of Transcentrix. He will be talking about a project that is being initiated in the Philadelphia area by DRMEC, and he will explain what that is, but it is a regional information sharing system called Rapid. Of course, that was mentioned this morning. In fact, everything we are going to get into more detail this afternoon have already been mentioned. Bill Ellis mentioned the first system of New York. We have Ms. Karen Tobia who will be explaining a little more about what that is all about. We had a brief introduction of x-ray

technology for container inspection. We will have a little more in-depth presentation of what that is all about and I assume how Customs is now demonstrating that process.

We will also have a presentation of optical scanning technology, giving us a little more information on its security application as well as the commercial side of that.

With that, I will invite John Lutz to start us off.

**John Lutz, Transcentrix**

**"Regional Information Sharing Systems – Internet Based"**

My name is John Lutz and I'm with Transcentrix Corporation out of St. Louis, Missouri. I will go through a little bit about what Transcentrix is during my presentation, but as far as a personal bio goes, I'm a technical guy. I'm really not a business guy. I'm a technical guy. I'm one of the old messaging dinosaurs. I came from the EDI world and have a primary background in railroads. But, I've done quite a bit of work with integration of Customs systems and some of the maritime systems. Right now, I'm focusing on inter-enterprise messaging, standards development, XML development, and web implementations primarily for intermodal logistics and transportation. So, with that introduction, I would like to keep it short because being the technical guy that I am, I just got in late last night and I took a look at this presentation that was put together for me by the business people, and I think I'm maybe a fish out of water when I start talking about these things. I would much rather prefer to talk about technical implementation issues.

However, what I am here to talk about is the DRMEC project and the Rapid Center. I thought that Duncan's presentation today was very apropos because he was talking about how important the commercial information is for number one security, and number two, actually being able to deal with the logistics supply chain – make the logistics supply chain work. The type of information that he was showing that is captured by his commercial system is the same kind of information that we need for our security and we also need it to make sure our supply chain visibility and all of our logistics within the supply chain can move effectively.

What Duncan didn't say in his presentation was that it is fine and dandy to have an individual system, just one system – that is the CSX Lines system, and that is used for CSX Lines' operations, and it is used for their trading partners. But, what about when we get the motor carriers involved in there, the steamship lines, and the railroads. Then, you have not only disparate systems, but you have disparate information.

So, what I'm going to talk about today is how we're trying to merge many of these disparate systems and provide a common, neutral database and a common, neutral system so that we can primarily make our intermodal logistics chain function for us more effectively.

So, today I'm representing DRMEC. What is DRMEC? DRMEC is the Delaware River Maritime Enterprise Council. Primarily it is a non-profit organization, funded by the State of Pennsylvania – the Pennsylvania Department of Community and Economic Development. Their mission is primarily in this one particular case to take a look at the Port of Philadelphia and its environs and to try to come up with a demonstration of how we can provide an integrated intermodal transportation system for Pennsylvania, limited to that particular port of Philadelphia and its corridors. I just want to mention here that although this is a regional project, it is really national in scope. It is like the Alameda Project – funded by the State of California; this is funded by the State of Pennsylvania but it really has national implications for being able to deploy your supply chain more effectively, and secondly, to be able to take that nationally.

Just to give you an idea of what these corridors are right here that we are dealing with, you see the Port of Philadelphia in here. These are mostly military corridors but we don't want to forsake the commercial opportunities and the commercial interests here in developing these corridors for the Port of Philadelphia. So, I'm just using this as an example so you can see what the current scope is, and then we can take it nationally from there.

The goals of DRMEC are really pretty easy. The first one is to facilitate end-to-end communication electronic tracking of goods and equipment. That means data capture. Whatever kind of systems we have are only as good as the data that we can capture. So, we have to make sure that we are not so stringent as to preclude any trading partner from giving us any type of data. What we really need to do is to be able to say who can give us what, when and how, and we have to be responsible for collecting that data and interpreting it. Talking about messaging standards, whether it be proprietary, X-12, or whatever, whether it be web-input – if we provide web screens and smart forms so that they can provide it via the internet, or whether it be OCR or fax, or anything – we need to be able collect this data in order to make these systems work. Every failure that I've ever seen in an implementation has to do with lack of data.

So, the most important thing that we need to do is to really facilitate the electronic data exchange, and therefore the system can maximize the commercial and military transportation capacities and it can improve ship, train, truck loading, and all the wonderful things. But, without the data, we are dead. So, we have to make sure that we can collect that.

So, how are we going to do it? As Richard said, we are going to create this thing call the Rapid Center and it is touted as being robust, North American/European tracking capability, which it is. Transcentrix – I'll go through our company in a little bit – but Transcentrix was Union Pacific Technologies in a new name. We have 4,000 trading partners. We're connected with every domestic carrier who can be connected in the U.S., Canada and Mexico. We do have tracing and tracking capabilities. We also have a partner called Euro-Log in Europe with 1,600 trading partners, mostly motor carriers in 21 countries in Europe. They are expanding into the Orient, putting an office in Singapore, and primarily we have some pretty robust trace and track capabilities amongst ourselves – Transcentrix in North America, and Euro-Log in Europe. Now, the trick is to put them together and to make them work.

What the Rapid Center will do is put them together and make these things work. It answers the current DOD procurement initiative of using COTS software, or using COTS solutions. These things are things that exist right now – no more new development needs to be done on our individual systems or our legacy systems. There was some comments about legacy systems today. But, we do not need to change our legacy systems whatsoever. What we need to do is we need to be able to integrate those legacy systems into one common, neutral format that will serve all of our needs. That is what the Rapid Center is going to do. Rapid Center is going to be owned and developed by the State of Pennsylvania, as I said. It is going to be a trusted third party, which means it is going to provide a neutral platform for the data.

Right now, I know there have been some other questions about security of data, particularly in intermodal transportation. I'll tell you something – from a railroad, a lot of times – let's take one example of a steamship line – OOCL. When OOCL bills traffic to our railroad, they bill their traffic shipper OOCL; consignee OOCL; 45-foot container FAK – because they don't trust us to know that they are shipping Panasonic televisions or whatever it is in that container. They don't trust us because we are another carrier. We're a competitive entity. They don't want us knowing who the shipper is because they don't want us going after their business. They don't want us knowing who the ultimate consignee is because they don't want us knowing the commercial business there. What Rapid Center is going to do, by being owned by the Pennsylvania non-profit, is to provide a trusted third party so that carriers will give the commercial information that is necessary in order to make your logistics supply chain run. So, this neutrality is really going to eliminate a lot of these issues and promote not only inter-agency data exchange, but also inter-enterprise data exchange there.

I just wanted to tell you that Rapid Center is being developed through intergovernmental and commercial cooperation. Its in-transit information, neutral portal for both commercial and military shipments. This is real important. I've been talking about commercial data all the time, but you need to have the commercial data in order to make the military logistics supply chain function better also. You can't just have trace and track. We need to now know, for security reasons and for our own inventory visibility reasons for the military, where is such and such and when is it going to be where it needs to be. Everyone has said they want to reduce deployment times by 80% right now. Well, you need to have commercial data in there. You just can't have any . . . . . come in that such and such is in Singapore. Well, when is it supposed to arrive at the final destination – we don't know. You really need the commercial data. You need the full route and you need people to report in to the full route. So, for military shipments, I can't stress enough that you need to be able to cooperate with industry. You need to cooperate with the commercial sector in order to really pull that data.

Just to give you an idea of our collaborative efforts right now, the Rapid enterprise is comprised of commercial entities, federal, state and local agencies. We have academic institutions and of course we have the military who are involved because those corridors that I showed you in the beginning are basically military depots coming in and out of the Port of Philadelphia. So, I'm using the slide just as an example of the collaborative effort that is going on right now within the Rapid Center.

I'm putting this slide up because it is interesting. It is something our company did in creating some of the application services that we have put up recently. Transcentrix, about a year and one-half ago, put together some marketing data for developing visibility types of products. These are shipment visibility products, inventory visibility products, whatever they may be. We went to our 4,000+ customers and asked them what are the most important things you need, what are the most important application services that you need right now in order to have an effective logistics supply chain. 83% of them came back, and we have 4,000+ mostly large commercial shippers, but 83% of them came back and said I need my raw materials. 83% this was the most important thing they needed to have to have an effective supply chain. 68% said that they wanted finished goods – these are like automobiles and tracing and tracking of the automobiles to the dealers, and that sort of thing. Then they said, but this is a real problem – we cannot affect this supply chain visibility. So, we said why not? What are your perceptions in here? If you take a look at these things, with the exception of the one in the middle here – the lack of electronic connectivity – not a one of these has to do with technology. They all have to do with business process. They all have to do with the disparate systems. They all have to do with trust. And, they all have to do with security of data. Take a look – the systems will not talk to one another – well, that was probably done by some manager who has no idea what the technology is. But, insufficient detail of information – this is what is lacking all the time between the systems. My system captures A, B and C, and yours captures D, E, and F. We can't exchange any information because we don't have a common basis whatsoever.

We have business process deficiencies. The business processes are different for each mode of transportation. They are totally different for each vertical industry that you're dealing with. Parties unwillingness to share information – that is a trust security issue. So, how are we going to get around these types of things? The way to get around it is to have some sort of neutral portal. We need a neutral portal by a trusted third party that would capture the necessary data that we're going to need.

To go through very quickly who is Transcentrix? Transcentrix was founded in 1987 as the information technology arm for the Union Pacific Corporation. At that time, we had a number of large corporations underneath us. At this point in time, we basically have Union Pacific Railroad and Overnight Trucking. Transcentrix was spun off of Union Pacific Technology. We have about 4,000+ customers. We do 1.5 to 2.0 million messages per day – that's EDI and proprietary. We operate a value-added network. We also have focused on application services and the application service that we focused on are supply chain management functions and inventory visibility, shipment visibility type of projects.

Our partner company is Euro-Log and they have established Euro-Log USA. They have 1,600 accounts in 21 countries, mostly in Europe. They are going to be establishing a Singapore office right now. They are very motor carrier oriented, very surface transportation oriented. We hope to be adding more and more modes, actually for us we hope to be adding more modes and Euro-Log hopes to be adding more modes on the continent also.

So, right now we're really focused on the U.S./European thing, or the North Atlantic corridor. However, the very first phase that we put up for the Rapid Center we have already done an

integration test on this for shipments moving from Houston to Singapore. So, we have managed to track things to Singapore using both of our systems and it worked just fine.

This is primarily what it looks like. We track the North American shipments; they track the international shipments. The ocean carriers report to both of us -- if we can get the steamship lines to report to both of us. We all feed the Rapid Center database so that we all have parallel visibility – everyone is going to have parallel visibility here and this is what the Rapid Center is going to look like.

So, why is it important? I'm sure you probably heard it in the beginning. It is going to shorten deployment times. You will have better inventory visibility. You will have alarms. Exactly what Duncan was talking about – you'll have alarms set. You can change from one mode to another. You can divert shipments. You can hold shipments. You can change shipments. You can do whatever you want to because you have the absolute up-to-date visibility of what is in transit at the time. It is going to greatly enhance the capacity in port staging areas in existing infrastructure. We are talking about asset utilization. If we know what is coming at us, we can be prepared for it.

Of course, it is going to increase transit visibility for military and commercial shipments. People are going to share the information. It can integrate disparate systems. I can go into the technical stuff later off-line if people would like me to. In looking at the security issues, primarily we're looking at threat detection and providing full information. Threat detection means capturing the commercial data and having that commercial data in the database. What kinds of goods are moving in here and who is the consignee and who is the actual shipper. Who is the beneficial owner on these things? These are things that need to be reported into the authorities so that they can actually do some profiling on OD pairs and they can do some profiling on types of goods or types of shipments, pattern shipments coming into the United States. So, by providing this full information and this full data in one common database, it is going to greatly increase threat detection.

I've already talked about contingencies a little bit. Contingencies can reduce deployment times because you can take it from a train and you can put it on a truck, or you can take it from a truck and put it onto another mode.

To wrap-up – why is the Rapid system important to threat detection? It is because it is a centralized, neutral, secure, portable portal that is going to provide the reliable, current information, not only on materiel, but it could provide it on people as well because we had the ability within our databases to create whatever kind of tracking object we want to create. Whether or not we barcode dog tags, I have no idea. But, we could create tracking objects for people and their modes of transport as well as materiel going through.

I think another important issue is that cargo and assets are being tracked using off-the-shelf technologies. Nobody is going to have to change their legacy systems. All you have to do is tell us – how are you going to get us the information – just get us the information, that is all we need. You can get it to us in any format that you want.

I think Rapid is really going to be able to do a better job in providing actual OD pairs. What we're doing is we're talking about prior origins to ultimate destinations. We're not just talking about modal OD pairs, like rail would have – Baltimore/Long Beach and then you would have Long Beach/Singapore, and then you would have Singapore/inland. We're actually going to have the ultimate destinations here and the prior origins which is going to be crucial for threat detection and security in the future.

So, that is it. Thank you very much.

**Terry Gibson, SAIC**

**"Optical Scanning Technology for Marine Gate Systems"**

Good afternoon – I'm Terry Gibson with SAIC out of San Diego, California. A little bit of a brief introduction – my experience in optical imaging started back in the early 80's. We were doing image processing with a company called Perceptics along the site of railcars. If you will remember back in those days, we had numbers on the side of railcars. We could acquire the image of a railcar as it went by, and then 45 minutes later, we could tell you the number and most of the time, it was right. The technology has come a long way in the last 20 years. I also heard you mention Crowley and Mar – those are two projects that actually participated in and was a part of Perceptics.

When I left Perceptics and went to work for Kodak in new camera developments, Mar was not very happy with the performance of the OCR technology. When they first installed it, they only got about 32%. But, you can see that the technology itself has come a long way. But, it is not just technology – and you will hear this probably from all the technologists – it is system, it is process, it is the overall encompassing solution. It is not just technology. Technology doesn't solve anything. Let me show you why.

This is an image. You are all very familiar with what this is an image of. Can anyone tell me what it is? You're right – it is a cow. You will never see that land set image again now that you see the cow. Does everybody see it? There is a fence behind it there. You'll never see the land set image you saw the first time I put it up there. It is always going to look like a cow now. What you just became was an imagine processing system. You took data in and you put it into some context. Even though you laughed at the guy who said it was a cow over here, you find out he was right. He was not a plant. But, you can see that is what it takes to be able to take data from a terminal and make it useful.

Before we go back into some of the optical scanning, let me give you a history background of what has happened on OCR on the terminals. In 1993, there was a test in Los Angeles. The test ran for 90 days. They were never able to achieve more than 50% regrade. Of the 50% that they actually read, 50% were wrong. You're not going to get your return on investment at that level

of performance. Crowley in Jacksonville installed a 90-day test in 1984 and they were able to achieve about 75%. I think the final number was around 77% with a 10% error rate. That is still not acceptable.

Elizabeth, New Jersey, which is the Mar terminal everyone talks about, took 22 months to get it actually functioning and operating the way it was supposed to – a long time. But, it is very successful today.

In 1996, there was the first installation in Europe at the ECT Terminal in Rotterdam – that was also one of my projects. I've had a lot of bumps in this area. It took 13 months. The difference was that we didn't have to read chassis over there – a huge difference. Those chassis numbers are very difficult to read. So, if you go back to 1982, over 10 years to get it to this level, and now we head on to the year 2001 where we have now progressed significantly.

One of the major advantages and significant improvements of the OCR technology was a partnership with UP Railroad in that they provided a small site in Kansas City, Missouri and over two years of development, not trying to stick it in and get a return on investment in the first year, but a partnership that they now have rolled the system out. The first site was Marion, Arkansas – when the first year of operations it did 430,000 containers. 87% of the in-gate and out-gate transactions were completely automatic – not just OCR – but the overall system. The driver pulls up, goes through the system, everything is OCR, he identifies himself at a kiosk which is nothing more than an ATM machine. He is cleared in less than one minute. The average of all drivers is less than 90 seconds. Eliminating congestion at the gate is one of the advantages of the technology. But, the technology by itself doesn't solve the problem. You have to use the OCR as one piece of the overall solution, integrating it with the gate technology.

Now, you will find there are multiple vendors supplying this. As anything else, is time goes along you get more vendors supplying solutions, technology goes down, and there are a lot of systems out there that are able every day to do automatic processing, character recognition, identification of containers – not quite so good on chassis still – but greater than 95%. The key here is that the error rate is less than one-half of one percent. We had a discussion earlier this week about error rates, and if I tell you 5% of the things you're going to have to process manually, you worry about that. But, we did a side-by-side test of an automated system and manual input from a set of operators. They had a 12% error rate of the data they were plugging in the system, and it was never known because no one went back and checked the data. Bad data doesn't do your system any good. You need to integrate that together and do all the necessary technologies, using expert system technology and other technologies. Even if you are going to use manual input, you need to be verifying that it is a valid number, that is a usable number, and it is data that fits into your system process.

Obviously since 09/11, there has been a lot of emphasis on safety and security. It is not impossible but dang near impossible to inspect every container that comes in every day. We don't have enough time in our system to do that. How do we then pick which containers should be inspected? How do we identify them and profile them? The data is out there. Customs is using a profiling system based on license plates on the borders today. That is another system I was involved in back in the early 90's. They profile the cars based on license plate numbers.

That technology works very well. You would be amazed to hear some of the stories of how accurately they identify the cars, OCR'ing in less than a half-second, and actually checking the database and knowing if that car is on a list of suspects that they want to pull over and talk to and encourage to let them view what is in their car. The same thing can be done with the technology John talked about – once you get the data points, you ensure that it is shared appropriately with the right people in creating the expert systems, just like you were with the cow, to be able to use the data.

In addition to increasing the safety and security with imaging, you also need to be able to improve productivity. We have already heard that somewhere between 18 and 25 million TEUs come through the U.S. and Canada already. It is going to double again. It doubled in the last 10 years, and it is going to double again. We are not going to be able to add enough terminals to be able to handle all of that additional productivity. How many of you are going to be happy with 12-15% error rates?

There was a study done in Long Beach at one of the terminals there – a test they gave out to the terminal clerks on education. Terminal clerks were given a test. They found out it was an eight grade equivalency test that only 20% of the clerks passed the test. So, systems have to be able to be implemented by operators that are going to use them. They can't be designed for PhD's and researchers. Again, it is the total system approach.

But, most importantly, as terminal operators, you won't get customers if you don't handle the equipment properly and you don't handle it quickly. As people involved in it, as Customs, you want to find the right container to inspect or you have to hire a lot of people to inspect all of them. So, you need to be productive and you need to use OCR technology.

What I'm going to do is show you some of the applications and implementations that are out there today in doing OCR on the ports and terminals. First of all, one of the technologies that is being implemented is not a typical imaging technology, but it is a biometrics using ultrasonics. That allows you to truly identify the driver. The advantage of ultrasonics over imaging on the fingerprint is that it also measures depth. Drivers that come to our terminals, people onboard the ship, don't necessarily have the most clean hands in the world and if you want to have them to wash their hands before they do a fingerprint scan, it isn't going to work. You need to keep the drivers in the trucks. That way you don't get in the way. They don't get run over by another truck driver and safety is very important as we just talked about. So, using this kind of technology, I can make very accurate measurements and identify a very specific driver. Canadian National Railroad is implementing this technology so that any driver that comes into their terminal to deliver a piece of goods will identify themselves with their fingerprint – no driver card that can be stolen or swiped, or no PIN number that can be told to a friend. That driver will have to actually and accurately identify himself with his fingerprint. Using the biometrics of an ultrasonics, he can't take and transfer his fingerprint on a piece of cellophane tape to someone else.

In addition to that, the ability to inspect a non-intrusive inspection that Vic is going to talk about a little more, but also the exterior of the container, and the ability to some day be able to inspect and find out if seals have been broken – that is certainly a real difficult time on the commercial

side to justify going to a $2.00 electronic seal when I pay $.05 for my plastic seals today. That is the easiest thing in the world – to hide a broken seal.

Also, the OCR capabilities – the other scanning technologies that are used out there – identifying accurately the container, the type and size code, and tracking that back and integrating it with the terminal management system to know where that container has been in the whole process.

A pedestal imaging system – this is an APL facility in Los Angeles, California – San Pedro actually – is being used to identify not only the container and the chassis, but the truck license plate number, reading the ISO number and the license plate of the truck. The driver can also then pull up to the pedestal because of the rules, and then pushes a button, calls in to the operator and they print his ticket. Recently, there was a change where the driver can now pull his ticket off that printer, never get out of his truck, and go park where he needs to go.

Imaging scanning allows them also to be able to open up the doors and look inside. The Panatel camera is up on the top of that and the operator can sit in the booth and actually look at the site. They can operate all 10 lanes with a lot less than 1.5 clerks per lane if they decide to do that and they get approvals from the Union to do that. But, it is not a technology problem. It is a process problem.

One of the things that APL told us at this very specific site where it is implemented is that 10% of the trucks that come in have errors in paperwork and otherwise that have to be sent over to be manually handled anyway. The concept is get them out of the lane so I don't have them backing up on the highway and have the California State Police come in and want to fine me for closing up the roadway to San Pedro and Terminal Island. So, process them quickly at the gate and move the exceptions off the way. Remember what we talked about with the Union Pacific System that is delivered there – getting them through the gate, clearing the things that are wrong and move them to the side and deal with them.

This is a portal system that is a little more complicated. This is actually the new Paragon Terminal in Amsterdam. Here it is an automatic process where there are no clerks on the in-gate. The clerks are actually located fairly far away and they are not walking up these trucks. The trucks come through the portal system. It does an OCR on the portal, on the container itself. It stores off a damage image. No one ever even looks at it unless they get a damage claim. It takes a snapshot of the rear of the container so you can actually see if the container has a seal on it or not. The truck then pulls completely through to the pedestal and swipes his ID card, which is what they are using there, and he is given a ticket to pull over to a valet area or a straddle carrier area, where the ticket has a barcode printed on it, and it issues a mission to the straddle carrier to come pick up that container. There are no clerks here at all, so it has improved the processing throughput. You don't have people out there doing inspections. Furthermore, it is actually improving the throughput of what they're trying to do at this terminal. It is giving you high resolution inspection images down to an eighth of an inch, looking for defects in the container itself.

I talked earlier about the gate stand and digital imaging is a part of that. Facial recognition is a capability that is there. One of the problems you have with facial recognition – the perfect

example – this is a reality. They wear those big hats down over their eyes and glasses over their eyes. So, it is hard to use facial recognition. So, you have to then tell the driver to remove his hat and glasses, or use some other technique. That is one of the reasons why Canadian National went to the biometrics as a capability. There are other people looking at this too. Through the printer system, you can print hazmat bills of lading. You can also swipe his CDL and at one of the other railroads we are working with right now, they actually want to be able to swipe the credit card so if they want any charges on it, they can just charge his credit card as he goes out. So, it gives you complete access control – you know who is going in and out of the facility. You know which container, which chassis and which truck came in and out of the facility.

One of the projects that was mentioned by Richard earlier is a project we are just beginning some work on – actually doing OCR on the crane itself at the sea legs. Mounting a bunch of cameras along the legs of the crane, the computer itself is up in the top, and we are trying to cover a whole 32 meters of area where the container comes in. Again, don't change how the operator operates the crane. The box will come through the window. One of the most technically difficult problems here is that containers come in at different lengths and widths. So, you have to deal with a 12.5 foot difference in your field of view. Think of looking right here to Bob and then immediately looking up with a camera and trying to get the image of someone in the back of the room. It is very difficult with a camera unless you do some sort of zooming and processing to get the same image. We, as humans, can do that. But, these are computers and cameras.

Unfortunately, not all containers have really good numbers on them. This is fairly typical. So, getting multiple sides of the containers is very helpful to be able to do the OCR capability. On the RTG, another program we are doing down in Savannah, is actually mounting cameras inside the spreader itself. This is going to be a much longer test because we're not sure how long the cameras are going to survive in the RTG. But, we are testing some . . . . cameras. From some experience with Kodak, I was doing cameras on crash cars. In this case, the number has been asked to be reported to the driver and the RTG, and he will then verify. It doesn't have to be that way. It is an operational issue – not a technical issue. Again, you get some good numbers and you don't get some good numbers. So, you have to interpret. You have two places where you have the potential for a number, but they are not always clear and easy to read.

I'll leave you with these last two systems of what we're doing here in technology. The one on the left is a mobile identification system. This is a combination of the RF technology and of a camera system that identifies the number on the container. The RF identifies the chassis tag. Integrating multiple technologies together enhances your ability to get accurate readings. That is really the capabilities. The system is being developed in conjunction with one of the ports in the terminals in the LA area. It is going to be a rapid deployment if they want to actually go out and verify specific containers or they are doing an investigation looking for things.

On the rail area, the rail actually stacks these containers two high. They create a consist list of what containers are on what railcar and they will issue that out. Again, there is a tremendous error rate of the data that is in the consist list because of what operator put what on which car. In his thinking, it is on the train – whether it is on car one, two or three – didn't matter to him. Whether it is on the top or bottom didn't matter to him. When it arrives at the destination and the truck driver is sitting there idling, and not being very pleasant at all about the fact that his

customer is calling him on the cell phone wanting to know where his goods are, he needs to know where that one is. If we are going to offer customers at the end of this process some extra special platinum service that they can get things quickly, they have to accurately know where they are. Being able to have accurate data is extremely important in the process.

I'll close by saying that technology is not a solution – it is a tool. To make it work, you have to integrate it together as part of the overall system. You've got to understand the whole systems approach and sit down many times with a pure white piece of paper and talk about the processes. Union Pacific would not be getting the level of throughput with the few number of people they have operating that terminal today if they didn't start with a white piece of paper and say, what are the processes that we really have to do and can we go back and change those . . . . ., or can we actually dictate a new way of operating our terminal, our port and our business.

Thank you.

**Vic Orphan, SAIC**

**"X-Ray Technology for Container Inspections"**

Good afternoon. My name is Victor Orphan. I'm Senior Vice President for Corporate Development at SAIC in San Diego. I'm a nuclear engineer by training and I've spent most of my career developing instrumentation based on nuclear techniques, electro-optical techniques. What I would like to do this afternoon is tell you about a very satisfying development called VACIS which we developed about five or six years ago in conjunction with the Customs Service. . . . . purposes, we really need to know what is in the container. That is really what I'm going to be telling you about – the technology which we think can be very cost-effective at telling us what is in the box, basically.

The technology is called VACIS – vehicle and cargo inspection system. What you see here are about six different manifestations of VACIS, depending on the application. What I would like to do is give you an overview quickly of the various versions, and I'll apologize for those of you who believe the title of the talk and thought I was going to talk about x-ray systems. I will apologize, but it would be unpatriotic to talk about x-ray systems since our company tends to build gamma ray systems. But, I can assure you that the gamma rays are just like x-rays. The only difference between a gamma ray and an x-ray is the way it is produced. X-rays come from a x-ray tube electrically generated and gamma rays come from an isotopic source. So, I think a lot of what I'm going to be talking about will apply to x-ray systems. I think this morning you saw an example of one of the x-ray systems that Customs is evaluating called the Eagle which is a straddle carrier based high-energy x-ray system.

This is the operating principle of VACIS. The gamma ray source is a very small pellet, just a few millimeters in diameter, and it is a tungsten-lead shield and it projects a fan-shaped beam, as

is illustrated here in the top view. We use two sources – either . . . . 137, which is 662 kilovolts, or cobalt 60, which has two gamma rays but average energy of about 1.25 million electron volts.

This, done in a cartoon fashion, shows how VACIS functions. The fan-shaped beam impinges on a linear array of very sensitive sodium iodine detectors. One of the keys to this technology is these detectors are about three inches thick. So, they are very efficient. We don't need a lot of gamma ray photons in order to make an image. In fact, unlike x-ray systems, this system can produce an image with about 100 times less radiation dose which is very important because in many of the applications, as you will see from some of my later examples, there are people in the containers. They are not supposed to be there, but in addition to smuggling drugs, there are people that smuggle people. You don't want to expose them to high radiation. Not that the x-ray systems would cause them any real harm, but I'm sure there would be a complaint and probably lawsuits filed. But, the dose we give to someone who is in the container is equivalent to being in an airplane at 30,000 feet for two minutes. I think all of you do that routinely. So, I don't think anybody could argue that we are harming anybody with that much dose.

The signals from the linear array of sodium iodine detectors are processed with a very simple PC-based workstation and the key thing to mention here is that scanning is very fast. As you will see, we can scan a 40-foot container in anywhere from 10 seconds to about one minute, depending on the particular type of VACIS system.

I'm going to just summarize the key features. I've already mentioned the source – the . . . Windows-based system. Then as you will see, it is a very modular design which facilitates a wide range of applications. These are two little animations that show you how the systems work, if I can get this stuff functioning here. The first one is a track and trolley system called VACIS II. The truck drives in. Even though the dose is very low, the regulations require that the operator get out. As the truck is stationary, the source and detector array move on parallel tracks at a speed of about a foot per second and in real-time, the operator sees the image being acquired as is illustrated there. Once that scan is completed, the driver gets back in, he drives off and another truck comes in and that process is repeated. So, you can see that the cycle time is probably on the order of 2-3 minutes per truck. There are 30 of these systems that U.S. Customs Service bought and about 25 of them are currently operational mostly on the southwest border.

The second system which actually we developed because we thought there would be a good application for it and fortunately it turned out to be true. Many of the seaports, where space is a big premium, having a mobile capability is very important. Here you see it is a self-contained unit where he is a detector array and the source is on the end of a boom. This is a commercial off-the-shelf boom, the type of boom that utility companies use to put a man up on a utility pole. The only thing we did was replace the bucket with a source shield. So, now if you want to scan a stationary truck or container, the truck drives by. On this system, we have speeded up the scan. This system can scan at speeds up to five miles an hour. Alternatively, you can operate it in the mode where the source and detector are stationary and you open the shudder after the driver is past the point of the beam, so right here it would open up and you can scan the truck as it is going by. In that mode, we have a Doppler radar on a tripod that monitors the velocity so that we can make sure we have a proper image with no distortion.

This is a quick summary of five of the VACIS systems and gives you an idea of how widely they have been deployed. This is a picture up at the Port of Vancouver where we were demonstrating the mobile VACIS for a period of a couple of months. Vancouver has just ordered a mobile VACIS and these are the types of images you get. As you can see from this list, U.S. Customs Service is, by far, our principal customer. They have bought quite a large number of VACIS II's as well as 30 mobile VACIS systems, of which more than half have been delivered. The National Guard also bought some in their role as support to Customs in a counter-drug area. But, they also have them available for weapons of mass destruction under emergency conditions. I'll tell you about a military version which is being operated right now by the U.S. Army in Cosovo for force protection. I mentioned the one in Vancouver.

We also have a system, which I'll show you in a minute, for scanning railcars. The first system was installed in May of last year at Laredo. To date, it has done over 300,000 railcars because we do 100% of every railcar that comes in from the U.S. That port has about 60% of all the rail traffic from Mexico. But, we are currently working on eight additional systems for U.S. Customs Service, and Mexican Customs like it so much they bought one for their own purposes, which they are going to use to scan for high-duty products which are being smuggled into Mexico.

There is a less expensive system for stolen auto recovery and seven of those systems have been delivered to Florida seaports.

We have a new system, pallet VACIS, of which the prototype is currently being tested at Osia Mesa.

This photograph of VACIS II shows several images.

Here are pictures of mobile VACIS. As I mentioned, I think this is a picture of it at Long Beach. Typical image from mobile VACIS, showing how you can detect contraband – in this case, the upper image shows that the same car inside of a container – in this case, we have inserted some explosive C-4 simulants and you see how easy it is to pick them out.

I should mention that this technology does not specific identify any material. You really have to go by the shape of the material or the fact that what you're seeing on the image doesn't track with the manifest. As someone mentioned in an earlier talk, I think John McGowan mentioned that this technology has been very successful at finding large quantities of drugs in hidden compartments in containers and in trucks where they will put marijuana, for example, in the ceiling of a truck. I think VACIS was credited with the largest seizure ever at the Otay Mesa border – 15,000 pounds of marijuana all hidden in the top of what was supposed to be an empty truck. Those are pretty straightforward. You don't need a lot of training to spot hidden compartments.

Here is a military mobile VACIS and it is actually pictures of it in Cosovo. It was a very foggy day when they took this picture in Cosovo. Here, unlike the commercial mobile VACIS, because the military wanted the detector array on a Humvee, the Humvee wasn't large enough to handle a large boom that would extend out 20-some feet. So, we actually put the source on a golf cart.

We call it our outsource vehicle. This vehicle was . . . robotically slaved to Humvee so that these would move together in synchronization. Likewise, you could set it up on the stationary mode and drive vehicles through it, shuddering the source while the driver was going through. This will show you how it operates here. These are some videos taken at the acceptance desk and will demonstrate that it really does scan at a pretty good clip. So, here it is in the mode where the vehicle you're scanning is stationary and the operators sits right in the Humvee and is viewing the image on a workstation in the Humvee.

The other mode is where it is just set up like an entry point screening, where it is stationary. The shudder is opened after the driver drives through and he just accelerates and we have a means of monitoring the velocity with the Doppler radar to correct the image.

These are some typical images that I believe were taken at Cosovo showing how they are primarily interested in looking for contraband, particularly weapons that were being smuggled into Albania at the time.

Now, railroad VACIS of course has to be a stationary system. This uses a . . . . . source right now, but perhaps cobalt will be added later. The detector array is 26 feet tall because we want it to handle double-stacked railcars. It has, as you see at the top, an angled section at the top in order to have the gamma rays come in at nearly normal to the detectors. Railroad VACIS is able to scan at a speed of up to 10 miles an hour, which is more than the speed that the trains come in because they are in a freight yard when they come in across the border. The other key component of this system is a RF tagging system which is made by Terry Gibson's group and it allows us to correlate the image of every railcar with an identification number so that Customs doesn't necessarily have to examine the image right away, but can do it later.

These are some typical images. We haven't found a lot of drugs being smuggled in the rail, but we sure have found a lot of people – over 1,000. My joke is that here we have people in the grain hopper car, they obviously were sold a coach ticket. Here we have the guys in the SUV and they were traveling first-class – either that or they got upgraded. This is a picture of the stolen automobile recovery system that we have installed at Dodge Island in Florida. It is a simpler system, as you can tell from these images. The image has just enough resolution to be able to tell you there is an automobile. There are four of these systems lined up at the entry point to Dodge Island. I should mention these systems are operated by the normal gatekeeper who takes the manifest from the truck driver. The image is sent remotely to a workstation where Customs inspectors can view it.

This is the pallet VACIS which has been in operation since about June at Otey Mesa. It was designed for Customs to solve a problem that Customs has of having high-density pallets which cannot be penetrated with the normal 450 kilovolt x-ray – things like frozen fish where the smugglers will hide drugs in the middle of the block of ice, basically.

This is a summary of the speeds. As you can see, one of the big selling features of VACIS is its ability to scan containers and trucks very rapidly.

Just some results that show you the penetration. With . . . . source, we get about 4.5 inches penetration, and with cobalt 60, about 6.5 inches penetration. This is a standard way of measuring penetration where you put a lead block behind varying thicknesses of steel and you see just where you stop being able to image the lead brick, meaning that the gamma rays or x-rays are not penetrating.

Typical resolution – I should point out that this is an image before we have corrected it and processed it. This is after we have processed it. We took out these artifacts which come from the fact that we used two columns of detectors. What is impressive is if you have a high contrast image like a copper wire, you can get sub-pixel resolution. Our pixels are about four-tenths of an inch, yet we can see down to less than .1 inch if it is a high contrast, and that is what this wire here is.

Here is an interesting example for tourism. It shows that by doing advanced imagine processing like a non-linear contrast stretch, you really can discern very subtle density differences. Here we have, in the original image, two barrels which, for all practical purposes, look identical. But, when you do the contrast stretch and apply a false color, you see that the barrel on the left here is of slightly higher density than the ammonia nitrate barrel on the right. So, that would allow you to not tell that is ammonia nitrate, but to tell if the manifest said it was all barrels of oil or water and one of them looked different, you would be suspicious.

Finally, I would like to just show you a concept of a system which I think would allow us to work toward a goal of 100% inspection and that is a crane-mounted VACIS. A lot of people will argue that you don't need 100% inspection, and that is probably true – you can use targeting to maybe live with 10-20%, but I think everybody will agree that you need better than 1.5%, which is what we are doing now. There may be circumstances where the threat condition is high, you may want to do 100%. If you know someone has told you they are going to bring in weapons of mass destruction into the country, you don't have a whole lot of choice – you are going to have to do something and you don't want to shut down trade while you do it. So, let me just show you this quick animation and then I'll be done.

I should mention that this is just very preliminary thinking and there are obviously lots of reasons why this needs to be designed more carefully. But, basically here is the container coming in and here is the detector array, and the source is off to the right. Our concept is that we would scan the container as it is being lowered onto the truck here. So, as it is being lowered down, with no loss of throughput, you would turn on the beam and just can it as it is being dropped down. But, since we can scan at 10 miles an hour, I don't think the lift drops it at any speeds faster than that. That would be 15-16 feet per second.

So, just to summarize – these are the advantages. This is why I chose to talk about gamma rays instead of x-rays – because I think gamma rays offer a more cost-effective solution. One of the things I think that Customs likes about gamma ray is this item right here – it is more reliable. We have achieved about a 97% availability and that is very important if you are doing day-in and day-out inspection. A higher performing system that is down half the time doesn't do you any good.

Thank you very much.

**Karen Tobia, Port Authority of NY and NJ**

**"Freight Information Real-Time System for Transport"**

The best part about being the last speaker is that you have heard everything so, I don't have to go into too much detail. I'm Karen Tobia. I'm with the Port Authority of New York and New Jersey. I'm Manager of Technology Planning in the Port Commerce Department. My function in Port Commerce is to investigate new technologies for port operations and freight handling. I've been working with Richard and Bob on the Cargo Handling Cooperative Program and several other organizations, looking at intermodal freight and moving freight through the port. I'm here to tell you about FIRST, which you've heard about a little bit in some of these presentations.

First, I just want to give you a very brief overview of the Port of New York and New Jersey which a lot of people have referenced in the course of the day. The Port of New York and New Jersey is the third largest port in the nation. We're the largest port on the East Coast. Last year, we handled over three million containers and 560,000 autos. We handle more petroleum products than any other port in the nation, along with bulk and breakbulk commodities. We also have passenger services including cruise ships and commuter ferry services. This (map) just highlights our major port terminals.

As you heard today, 95% of all cargo coming into the country comes by ship. The Port of New York serves a region of 18 million people locally and a larger population of 80-90 million within a 10-state region.

Major challenges – I'm not going to really go over this because you've heard it all today, between yesterday and today. The larger ships and the anticipated doubling of cargo have created challenges for all ports, not only in New York and New Jersey. One of the things that we were looking at is how can ITS technologies and other technologies help us to do something quickly to try to mitigate some of the congestion on the port. What we did three years ago (the end of 1999) was convene a group of representatives from the port community. They represented all areas of freight movement in the port. We had brokers, terminal operators, steamship lines, regional transportation agencies. We sat around a table and said what can we do and do relatively quickly and relatively inexpensively? How can we improve efficiency, improve our trucker productivities, reduce our congestion, and improve the work flow? Out of that came FIRST. The concept of FIRST was to take all of the information, again as you have heard all day long, take all this data that is going back and forth to move this cargo, put it all in one place that can be accessed by the trucking community, the freight forwarders and brokers, the shippers. Beyond that, to integrate waterside information, landside information, to create a port information management system – a one-stop shopping site.

Similar to what John was saying before, FIRST is not a proprietary system. The community asked the Port Authority to lead this effort, which we agreed to do. We got some federal funding through New York State DOT and the I-95 Corridor Coalition and the Port Authority, to build the system. We did a request for proposals and hired an outside company, Americas Systems, to be the third-party provider for the system. It was very good that happened because all of the hardware and software was housed off-site and therefore was protected on the 11th.

This is FIRST. All of the data elements that have been discussed over the past couple of days are a part of FIRST. We use the EDI message sets for the actual bill of lading, status changes, manifests, and that information is sent via flat file (FTP) over the internet. We have also incorporated the Port Authority SEA LINK® database of trucking companies and truck drivers. Every trucking company and truck driver has to have a SEA LINK card and be registered in the SEA LINK system to do business at the port. So, we have a great database of over 35,000 to 40,000 truck drivers that come through the port. That information is incorporated into FIRST. We will be providing real-time video from on-port. We are in the process of upgrading our CCTV cameras on port facilities and will be providing that data. And also by January, we will be getting information directly from the Transportation Coordinating Committee, TRANSCOM (not USTRANSCOM) but TRANSCOM for New York, New Jersey and Connecticut, that provides highway management information and incident information from all of the transportation agencies in the tri-state region.

We have a link to PORTS and we provide the PORTS data and we hope to get information from the vessel traffic service. We were getting a feed from there, but after the 11th, the Coast Guard shut that down. So, that is a little out of business right now.

We also will be working with the Sandy Hook Pilots. They are putting together a system consisting of a database where they can put the actual arrival times from the ships when they board the ships to bring them in – they use wireless laptops and they will be inputting that data. That information will also become a part of FIRST. In addition to that, we currently get the vessel arrival schedules for the week and we will have the ability for the harbor master from each terminal to input that data directly into FIRST.

Down the line, we will be interfacing with Cargo*Mate. Cargo*Mate is a demonstration project under the auspices of the Intermodal Freight Technology Working Group, of tracking chassis. We will be interfacing with that system.

Not shown here is Operation Respond, which is another system that has a database of hazmat information and we'll be entering into an agreement with them to link up container information with hazmat information for incident management and incident response. As Bill Ellis mentioned this morning, FIRST will be a big component in our PIDN system when we get that up and running.

The good thing is, FIRST is live, FIRST is real and FIRST is out on the web at www.firstnynj.com. FIRST was officially launched on September 5th. They say timing is everything and as I mentioned before, FIRST was not affected by the events of the 11th and as a matter of act, FIRST did become a great source of information. We were able to post a lot of

information about the port activities, Coast Guard activities, etc. on FIRST almost immediately and we have been continuing that. This is our home page. The home page, as I said, gives you the latest news and any pertinent information. We can update it whenever we want. It gives the listing of the current data providers and participants. I think, as Terry said and John said, the data is what is key to a system like this. If you don't get the data, you don't have a system. We have three of our terminals that are participating and those are the lines that have agreed to provide us with data. That has been the biggest challenge in this whole project and in some of the other projects that we have heard about that people have been thinking about – that is the greatest challenge. I've been working on this for three years and I've been trying very hard to convince the carriers and the terminals that this is the way to go and to share that data. It has been very tough. So, it is the institutional barriers, as was mentioned before, not the technology that provides the problems.

Anyone can go on FIRST. If you have a container number and it is from one of our participating data providers, you can enter it in the quick search section and it will bring up the current status of that container. If you want to become a registered user, you will have access to more functionality. This is a screen shot of container information that a registered user would receive and you will see that we will show demurrage information, the holds, the status and releases, and again the latest movement. You can also scroll down and get container history for 90 days and this information is constantly updated. As fast as we get the data from the terminals or the lines, this is as fast as the data goes in. You can also do a booking inquiry – just put in a booking number and the ocean carrier SCAC code and you can get information on a booking.

A couple of the main features that we built into the system was a feature for nominations. A registered carrier or a shipper or broker could actually go into FIRST and nominate a trucking company for a particular container. Again, this is because we have the functionality of the SEA LINK trucker database and what will happen is they'll go in, nominate a trucking company for the container, and that goes on a watch list for the trucking company. There are a series of different colored lights that will indicate that status of that container – whether it is released, it is on hold, or it is off the terminal. Then the trucking company has the ability to actually go in and assign the driver through the SEA LINK database. Then the carrier and the terminal can know who the driver is going to be for that particular load.

All registered users have the ability to create watch lists where they would just enter a container that they are watching for status changes and the screen refreshes every 30 seconds and it constantly updates as the data is coming in.

These are some of the benefits that we find. We really think that with a system like this, and getting that information out ahead of time, it will allow, especially the trucking community, to have all the information at their fingertips before they go out and go to pick up cargo, and they are not sitting out on the line and waiting.

Again, as I said, it is a port community system. All the segments of the community have participated in this and we just continue to get data. We have a contract with Americas Systems running to September 2002. During this period of time, we will be evaluating the system. SAIC

is doing the evaluation for us on behalf of the Federal Highway Administration. Hopefully, we will find out that the system is successful.

Thank you.

Walker – We do have a minute or two for questions. I definitely will not keep you over because I realize this is a late hour. Are there any questions of the panelists?

Question – I'm with Customs in Seattle. That FIRST system is really neat and we'll be out to talk to you, I'm sure very soon. I have a couple questions about data. The first thing I would like to share with you is that Customs have something we call the automated targeting system. It acquires all the information. I'm just a little bit confused because I think Customs has a responsibility for screening all the stuff that comes into the country. I think when private organizations start accepting some of that responsibility, I think you need to come and talk to us about it. I'm not in Customs management, but I think you need to look at that very carefully. The other thing is that you all talk about the data and the kind that you need. I can understand the information about the cruise number and I can understand things about dates, when the ship departs, when it arrives, etc., and I can understand information about container number. Beyond that, I'm really confused why organizations outside Customs or out of the people who actually own or are responsible for the cargo itself, need detailed information about the cargo. I wonder if you could talk about that – or maybe I just misunderstood you – maybe you're only talking about container number and cruise number for the ship and dates and things like that? You said the only information you're acquiring is container number and possibly container owner and maybe a little more information about timing of the container. But you are not really acquiring information of what is inside the container?

Tobia – No, we're not. We're not doing the contents.

Question – The other thing is why do you need the consignee and the shipper – why do you need that information?

Lutz – Well, I can talk about for primarily intermodal movements. We have a real problem if we're talking about an end-to-end movement because most of the reportings and the reportings that I just saw are just port-to-port, so you don't have ultimate origin/destinations. This is data that you want to share with your shipper because what we are doing is providing in-transit visibility, shipment management services for the shipper so they can see it. What has to happen right now is let's take a typical movement from Seoul to Houston, an empty container coming back, what that shipper has to do for their logistics supply chain so they know when that empty iso container is coming back, they have to be able to track the motor portion of that from Seoul to Bonson, Korea, and then they track it separately from the steamship line from Bonson to Long Beach, and then it hits the Union Pacific Railroad in Long Beach and the only thing they have is an OD pair. You have two different freight forwarders booking this movement. You have two different Customs brokers dealing with the movement. And, the shipper itself does not have the capability to be able to integrate all that information to be able to see where this is. So, they have absolutely no idea where their empties are coming from or when they are going to come home.

Question - . . . anything about cargo information itself? You're still talking about the container and the containerizee, and possibly the shipper or consignee?

Lutz – Well, it is shipper and consignee OD pairs, and then for safety reasons, the carriers also need to have that information of what they are carrying as opposed to FAK. So, primarily it is who piggybacks the data. We are trying to provide a data repository. That data repository is only available to those parties who have a legal right to that data.

Tobia – The FIRST system gets all the data. We get the entire manifest. But, the only thing that gets populated to the website is the basic information. We drop the other information on the floor. We don't use it. Or else, no one would give us any data.

Comment – I guess we are seeing the same thing too. We have to collect that data for those who need to know, but it is not shared via website at all. It is for the use of the shipper.

Tobia – They don't want to share that data and they don't want that data to get out. So, that has been the difficulty in getting them to play. You mentioned Seattle – we did have some conversations with Seattle. We have had several ports come to us with an interest in the system and we have demonstrated the system and we would be more than happy to deal with any port that would like to participate in it.

Walker – Let me see if I can allay your fears. The agile port demonstration in the Pennsylvania area was actually started by the military to look at rapid deployment and to look at the potential of fast ship and some other technologies that were coming down the pike. So, the level of detail that these two people are talking about were actually designed by the military. But obviously, you would have firewalls to have people to access only the part that they have relevance to.

I would like to personally thank the panelists again and please join me in a round of applause for them.